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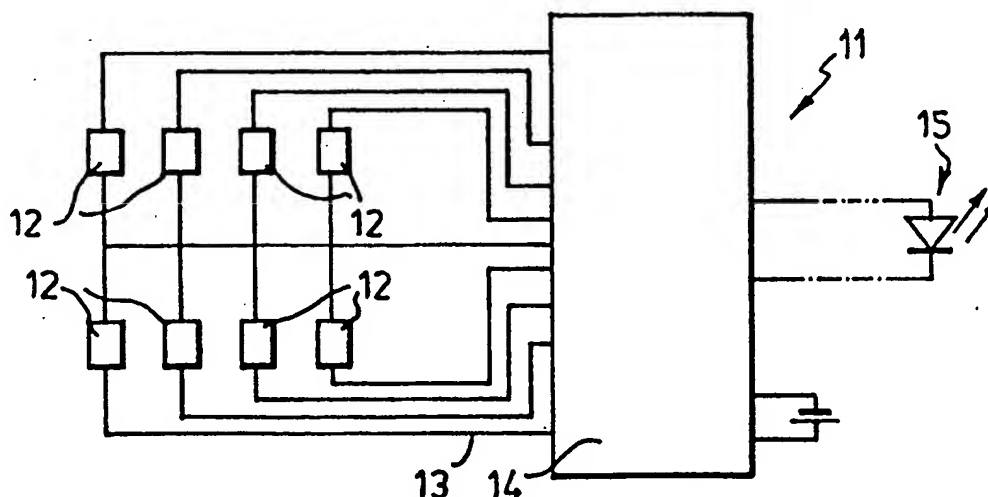
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶: G01N 33/00	A1	(11) International Publication Number: WO 95/32422 (43) International Publication Date: 30 November 1995 (30.11.95)
(21) International Application Number: PCT/GB95/01172 (22) International Filing Date: 23 May 1995 (23.05.95) (30) Priority Data: 9410411.4 23 May 1994 (23.05.94) GB (71) Applicant (for all designated States except US): AROMAS-CAN PLC [GB/GB]; Electra House, Electra Way, Crewe, Cheshire CW1 1WZ (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): McNEIGHT, David, Leslie [GB/GB]; Brow Top, Lees Lane, Wilmslow, Cheshire SK9 2LR (GB). PAYNE, Peter, Alfred [GB/GB]; 13 Chelworth Manor, Manor Road, Bramhall, Cheshire SK7 3LX (GB). PERSAUD, Krishna, Chandra [GH/GB]; 65 Mersey Bank Avenue, Chorlton, Manchester M21 7NT (GB). (74) Agents: McNEIGHT, David, Leslie et al.; McNeight & Lawrence, Regent House, Heaton Lane, Stockport, Cheshire SK4 1BS (GB).		(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: SENSOR



(57) Abstract

There is disclosed a sensor comprising a plurality of electric circuit elements sensitive to different substances, an electric circuit including said elements and circuitry in said circuit responsive to the condition of said circuit elements and connected to an output device, said circuitry being adapted to actuate the output device in response to one or more combination of conditions of the individual circuit elements.

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SENSOR

This invention relates to sensors.

Sensors for gases or vapours (hereinafter "gases") are known in which a substance whose electrical properties are changed on exposure to a particular gas or gaseous mixture is included as a circuit element with circuitry measuring one or more of its electrical properties such for example as resistance. A typical substance is a semiconducting polymer such as a poly- pyrrole.

It is known to use a plurality of such circuit elements of different substances that react differently to different gases or gaseous mixtures - any one substance may react to several different gases or gaseous mixtures, but a plurality of different substances will collectively react in different ways to different gases or gaseous mixtures facilitating differentiation.

Sensors of this kind are mounted in an arrangement through which a sample can be passed, a sampling system being connected to the duct to sample the air from, say, bottle or drum containing it. The sensor array is connected to a computer which has a

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software-configured neural net which can be trained to identify gases or mixtures by exposure to known gases or mixtures and adjustment of its hidden units to produce the correct response. Clearly, a hardware-configured neural net can be developed for such an arrangement.

Such sensor arrangements are suitable for laboratory use and there is clearly scope for producing a range of specially designed instruments that can be adapted for use in different working environments. The computing power required, however, when enough different sensors are employed for most purposes, and the sampling arrangements involve a certain level of expense, and, of course, impose certain restrictions on the way in which the arrangements can be used.

There are circumstances where such equipment is too expensive and difficult to use, yet where the ability to detect certain gases or mixtures would be highly desirable. One such circumstance is in the detection of gases arising from microbiological activity, e.g. certain pathological conditions such as necrosis or infection in wounds. The wound dressing would ordinarily prevent access for a probe.

There are, however, many other circumstances such as fermentation monitoring in the brewing industry.

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The present invention provides a sensor which can be used in such situations and which despite utilising the technology of the expensive arrangements currently available is a low cost, easy to use item.

The invention comprises a sensor comprising a plurality of electric circuit elements sensitive to different substances, an electric circuit including said elements and circuitry in said circuit responsible to the condition of said circuit elements and connected to an output device, said circuitry being adapted to actuate the output device in response to one or more combinations of conditions of the individual circuit elements.

One or more of said electric circuit elements may comprise a semiconducting polymer.

Said circuit may be comprised on a support on which said circuit elements are exposed.

A power source for said circuit may be carried on the board - a hearing aid battery or like sized battery, for example.

Said output device may comprise a two state indicator - it may not be important to know precisely

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what has been detected, merely that something, one or more of several gases has been detected.

Such a two state indicator may have a power-on and a power-off state - a light emitting diode (led) for example - and while it might be desired to have a lamp such as an led light up to indicate an alarm condition, it might be desired as a fail-safe measure to have the light normally on as an indication that the sensor is functioning - a separate battery state indicator could, however, be provided. The output device may be latched so as to indicate a condition has arisen even after that condition has changed.

For a wound condition sensor, the elements will be sensitive to gases indicative of a pathological condition or infection and may be designed to be accommodated in a wound dressing with the output device exposed. The output device may be on an extension from said circuit, which may be a trailing lead, which may also carry a power source for the circuit, enabling the in-dressing component to be smaller and facilitating battery change.

Embodiments of sensors according to the invention will now be described with reference to the accompanying drawings, in which :-

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Figure 1 is a diagrammatic illustration of the circuit of one embodiment;

and Figure 2 is a perspective view of a sensor embodying the circuit of Figure 1.

The drawings illustrate a sensor 11 comprising a plurality of electric circuit elements 12 sensitive to different substances, an electric circuit 13 including said elements 12 and circuitry 14 in the circuit 13 responsive to the condition of said circuit elements and connected to an output device 15, said circuitry 14 being adapted to actuate the output device in response to one or more combinations of conditions of the individual circuit elements.

One or more of said circuit elements may comprise a semiconducting polymer, such as a polypyrrole. A set of different such polymers may be used, reacting differently to different gases or to humidity so that any one combination of reactions is indicative of the presence of a single gas.

The circuit 13 is comprised on a support 16 on which the circuit elements 12 are exposed. As seen in Figure 2, the circuit elements 12 are under a permeable cover member 17, such for example as a wire or plastic

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or textile gauze or a semipermeable membrane primarily to keep the elements 12 dry. The support 16 need be only, say, 2 x 4 cm in width and length, and no more than 1 cm in depth whereby it can easily be accommodated inside a wound dressing or a plaster cast. Even a power source in the form of a hearing aid battery or like small battery can be accommodated in such a support.

The output device 15 is a light emitting diode (led) which is a simple two state indicator, being either on or off. It might be desired to use a red led which illuminates to indicate the presence of a gas arising from an infection or other condition being monitored, but it may be preferred to have, say, a green led which in its on state indicated that the battery is working and no alarm condition is detected. An alarm condition might be indicated either by the led being in its off state (which might also indicate a battery change) or flashing.

In case it should be desired to indicate any transient alarm condition, the output device 15 may be latched so as to indicate that such a condition has arisen even after that condition has changed.

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The elements 12 are sensitive to substances indicative of a pathological condition and the sensor 11 is adapted to be accommodated in a wound dressing with the output device 15 exposed. Whilst an output device 15 in the form of an led may be able to project between the wraps of a bandage, for larger dressings and plaster casts, where the wound may be deep within the dressing or cast, the output device 15 is on an extension from said circuit 13 in the form of a trailing lead 18. The led 15 is accommodated in a holder 19 which might also be adapted to hold a larger battery than could be held in the support 16 and that could be changed without undue disturbance to the dressing or the patient.

The support 16 could be a thin flexible substrate which could have the circuit 13 and the elements 12 and a semipermeable covering membrane printed or otherwise deposited on it, and such an arrangement would be capable of conforming to the bandaging and be more comfortable than a rigid sensor.

A liquid crystal display output member would consume less power than an led and might itself also be printed on a flexible substrate, yielding an inexpensive, disposable sensor eliminating any risk of cross-infection and the requirement for sterilising more expensive devices that have to be reused.

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It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

CLAIMS

1. A sensor comprising a plurality of electric circuit elements sensitive to different substances, an electric circuit including said elements and circuitry in said circuit responsive to the condition of said circuit elements and connected to an output device, said circuitry being adapted to actuate the output device in response to one or more combinations of conditions of the individual circuit elements.
2. A sensor according to claim 1, in which one or more of said electric circuit elements comprises a semiconducting polymer.
3. A sensor according to claim 1 or claim 2, in which said circuit is comprised on a support on which said circuit elements are exposed.
4. A sensor according to claim 3, comprising a power source for said circuit.
5. A sensor according to any one claims 1 to 4, in which said output device comprises a two state indicator.
6. A sensor according to claim 5, in which said two state indicator has as power-on and a power-off state.

7. A sensor according to claim 6, in which on actuation by said circuitry to indicate an alarm condition said indicator changes from its power-on to its power-off state.

8. A sensor according to any one of claims 1 to 7, in which said output device comprises a lamp such as a light emitting diode.

9. A sensor according to any one of claims 1 to 8, in which said output device is latched so as to indicate that a condition has arisen even after that condition has changed.

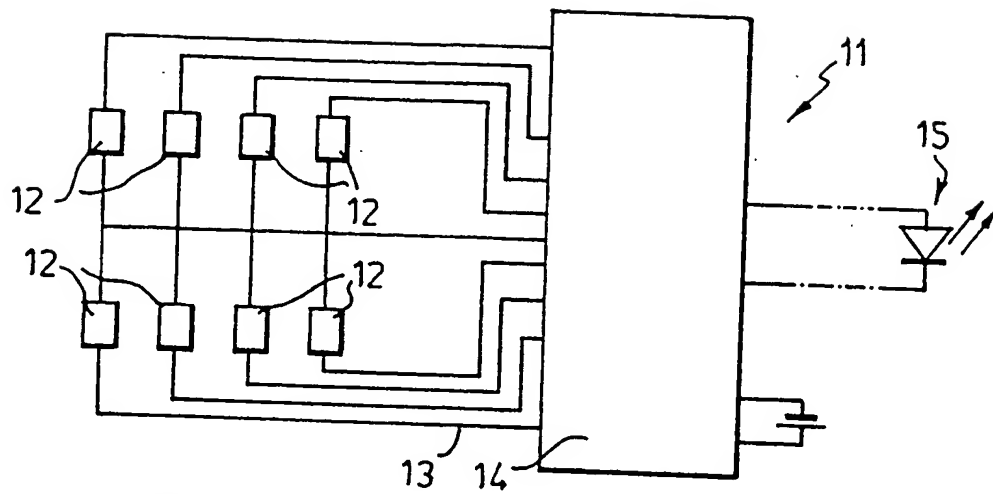
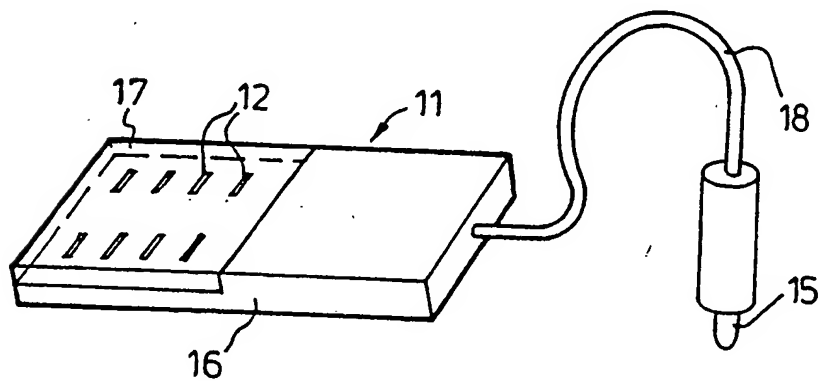
10. A sensor according to any one of claims 1 to 9, in which said elements are sensitive to substances indicative of a pathological condition and is adapted to be accommodated in a wound dressing with the output device exposed.

11. An sensor according to any one of claims 1 to 10, in which the output device is on an extension for said circuit.

12. A sensor according to claim 11, in which said extension is a trailing lead.

13. A sensor according to claim 11 or claim 12, in which a power source for said circuit is also on said extension.

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FIG. 1FIG. 2

PCT/GB 95/01172

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01N33/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,93 03355 (NEOTRONICS LIMITED) 18 February 1993	1,2
Y	see the whole document	3-9
Y	US,A,4 250 737 (BIGLIN) 17 February 1981	3-9
A	see the whole document	11-13
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Date of the actual completion of the international search

11 October 1995

Date of mailing of the international search report

13.10.95

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A	<p>PROCEEDINGS OF THE ELECTRONIC COMPONENTS CONFERENCE, ATLANTA, MAY 10-12, 1982, vol. conf. 32, 1982 NEW YORK, IEEE, US, pages 290-295, HIDEO ARIMA, ET AL. 'NEW CITY GAS DETECTOR USING A THICK FILM HYBRID SENSOR' see figures 14,15</p> <p>-----</p>	<p>1-9, 11-13</p>

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